

# Phantom Power Testing with the MR-PRO



Minirator MR-PRO measures phantom power

Phantom powering is ubiquitous in professional audio. The MR-PRO includes special features to continuously monitor and display DC voltages present at its output. The MR-PRO may be connected to the microphone input of the mixing desk and continuously measures the actual effective phantom power with or without load. This application note describes how to test conformity of the phantom power source in use according to the relevant IEC 1938 standard.

## General

Phantom powered devices are commonly used in the audio industry. As no additional conductor for power supply is required both the signal- and power-path share the same connections, thus only one cable is required, applicable at e.g. microphones and preamplifiers.

Standard IEC1938, covering specifications of audio and video interconnections, also comprises the definition of phantom power for balanced audio. These specifications, listed in Table 1, determine power and DC-voltage available to the device based on DC-load impedance. The phantom power voltage is listed as e.g. P24 (= phantom 24 Volt).

PhantomPower	P12	P24	P48
no load voltage Pph0	12V+/-1V	24V+/-4V	48V+/-4V
supplied current up to Imax	15mA	10mA	10mA
R_phantom	680    680	1.2k    1.2k	6.8k    6.8k

Table 1, Balanced phantom power supply specifications acc. to IEC1938

Surprisingly often audio phantom power sources can be found not conforming to the standard. This can severely affect performance of connected devices. Giving some examples:

- maximum sound pressure level available in the operating range of analog microphones may be lowered, if available output voltage is lower then to be expected from the standard
- sensitivity of analog microphones may be changed, if phantom power impedance is incorrect
- frequency response of analog microphones may break down at low frequencies if the microphones includes capacitive output coupling and phantom power impedance is lower then given in the standard
- power hungry devices (as some digital microphones) might not even start to work
- connecting of a P12 or P24 device to a non-standard impedance P48 may damage the device

PhantomPower	P12	P24	P48
Umin @ Imax	5.9V	14V	10V
p_load @ Imax	88mW	140mW	100mW
p_max @ Uph0 nominal	106mW	240mW	169mW
I @ p_max	17.6mA	20mA	7mA

Table 2, Characteristic phantom power supply parameters for R&D

Besides others Table 2 lists the minimum voltage  $U_{min} @ I_{max}$ , which is available to the remote powered device. It can be measured at pin2 (or pin3) relative to pin1 if the maximum allowed current  $I_{max}$  is drawn and if voltage  $U_{ph0}$  (no load phantom voltage) is at its minimum specified value. In case the DC-impedances are matched between phantom power source and connected device, the maximum power will be available, thus DC-voltage at pin2 and pin3 will be just half the no load voltage  $U_{ph0}$ .

The available power is maximized for P24 and so recommended by the IEC for new designs. But still P48 is the most widespread phantom power voltage. This is due to the fact that using P48 with analog microphones circuits allows for maximum available sound pressure level by less expensive circuits.





